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*Original Research*

# Is there a relationship between temporomandibular disorder and sacroiliac joint dysfunction?

Is tmd associated with sjd?

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**Abstract**

Aim: The aim of this prospective clinical study was to evaluate the possible association between temporomandibular disorders (TMD) and sacroiliac joint dysfunction (SIJD) and to determine the immediate effect of a single session of orofacial manual therapy (OMT) on SIJD.

Material and Methods: Twenty-four patients, aged 18 to 60, diagnosed with both TMD and SIJD, underwent a single-session OMT treatment. Orofacial pain, pressure pain thresholds (PPT) in the masseter, temporalis, and spina iliaca posterior superior (SIPS), temporomandibular joint (TMJ) range of motion (ROM), hipomobility in the SIPS, and functionality were evaluated before and after the treatment.

Results: A statistically significant improve was observed in the Orofacial pain scores, all TMJ ROM values, PPT in masseter, temporalis, and SIPS, Patrick's Faber test score, and Oswestry Disability Index score after treatment in all participants (p = .000).

Discussion: Assessing and managing the joints together can lead to a more comprehensive evaluation of patients with Sacroiliac and Temporomandibular joint dysfunction symptoms, enhancing the overall effectiveness of the treatment.

**Keywords:** Temporomandibular Disorder, Sacroiliac Joint, Facial Pain, Manual Therapies

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## Introduction

Temporomandibular disorder (TMD) is a specific category of orofacial disorders that encompasses issues such as temporomandibular joint (TMJ) pain, fatigue in the craniocervical muscles—particularly the masticatory muscles—restricted movement of the jaw, and clicking or deviation during jaw movements [1]. TMD is a prevalent issue in clinical settings, affecting approximately 33% of the general population [2]. The most frequently reported symptom is facial pain, which can present as either acute or chronic [1]. The causes of TMD are diverse and include factors such as anxiety, stress, bruxism, alterations in occlusion and posture, dysfunction of the masticatory muscles and other bodily structures, or a combination of these elements [3].

Sacroiliac joint dysfunction (SIJD) is one of the most common causes of non-discogenic low back pain. With a reported incidence of 10-27%, it is also responsible for mechanical and chronic hip or leg pain [4]. The relationship between occlusal disorders of the TMJ, cervical spine and sacroiliac joint (SIJ) has been evaluated and coexisting dysfunction in these regions has been obtained [5]. Cases of TMD have been reported in which lumbosacral pain and malocclusion were successfully treated together [6- 7]. These results suggest a functional connection between these regions. This connection is based on diaphragms, neural connections, and the presence of myofascial chains [8, 9]. Based on these findings, this study focused on the possible relationship between TMD and SIJD.

The aim of this prospective clinical study was to evaluate the possible association between TMD and SIJD, and to determine the immediate effect of a single session of orofacial manual therapy (OMT) on SIJD. The hypothesis was that a single session of manual therapy applied to the temporomandibular joint can reduce complaints related to the sacroiliac joint.

## Material and Methods

### *Study design and participants*

This study was conducted on patients aged 18–60 years diagnosed with TMD - reduction disc displacement between September 2023 and March 2024. This study was approved by Ethical Committee (Decision no: 09.2023.675). All the study procedures conformed to the provisions of the World Medical Association Declaration of Helsinki. Patients who agreed to participate in the study were included in the study if they gave verbal and written informed consent. This study was registered in the WHO International Clinical Trials Registry Platform (NCT06035341).

Patients with orofacial pain who presented to the Department of Otorhinolaryngology at Outpatient Clinic and were diagnosed with Temporomandibular Disorder with reduction disc displacement, based on physical and radiological examinations conducted by a specialist physician, were subsequently referred to the Orthopedics and Traumatology Department. In this department, the patients were evaluated for sacroiliac joint dysfunction (SIJD) by an Orthopedics and Traumatology specialist. Those patients who were diagnosed with SIJD in addition to Temporomandibular Disorder with reduction disc displacement and who agreed to participate in the study were included in the research.

Patients were excluded from the study if they had a history of malignant condition, trauma or surgery in the cranial or cervical region, are uncooperative, use regular analgesic or anti-inflammatory drugs, have dentofacial anomalies, active inflammatory arthritis, metabolic diseases (Gout, osteoporosis, Cushing's disease, and hyper/hypo parathyroidism), connective tissue, rheumatological (Systemic lupus erythematosus and scleroderma) and hematological disorders (Anemia and leukemia), diagnosed psychiatric diseases, and received TMD-related physical therapy less than 6 months ago.

### *Assessment Methods*

Demographic and clinical characteristics of patients were recorded. As evaluation parameters orofacial pain, pressure pain threshold (PPT) in masseter, temporalis, and spina iliaca posterior superior (SIPS), TMJ range of motion (ROM), functionality and mobility in SIJ were evaluated. Orofacial pain, PPT, TMJ ROM and mobility in SIJ were evaluated before treatment and 5 minutes after treatment. Functionality was evaluated before treatment and 1 week after treatment.

Orofacial pain was evaluated using the Visual Analog Scale (VAS). This scale consists of numbers from 0 to 10. Accordingly, "0" describes no pain, and "10" describes unbearable pain. The patient was asked to mark the intensity of the pain he/she felt and it was explained that the intensity of pain increased from 0 to 10 [10].

Mandibular movements depression, right and left lateral excursion, protrusion, and retrusion) using a 15 cm ruler. Individuals were asked to perform these movements as much as possible without causing pain. The distance between the maxillary and mandibular central incisors were measured using a ruler. Measurements were recorded three times and the average of the recorded measurements were noted [11].

A digital algometer (Jtech Medical Commander Algometer) was used to objectively measure the PPT. The algometer was checked by pressing the pulp of the thumb of the hand before starting the measurement. Then, pressure was applied 1 cm below the SIPS and on the central TP of the masseter and temporalis muscles by increasing the pressure by 1 kg/cm$^2$ every three seconds until the individual feels pain. The physiotherapist passively supported the individual's head with the other hand. The individual was instructed to report when they felt pain while applying force with the device (kg/cm$^2$). Three pressure pain threshold measurements were made with a 2-min rest interval between trials. The mean of the 3 trials was calculated and used for analysis [12].

The Patrick-Faber test was used to assess the mobility of the sacroiliac joint. For the measurement of the test, one examiner stabilized the patient while another measured the vertical distance in centimeters between the mark on the lateral edge of the patella and the base. A greater distance indicated higher tension in the adductor muscles and less sacroiliac joint mobility [5].

Functionality was assessed using the Oswestry Disability Index (ODI). The ODI is a valid and reliable questionnaire that evaluates daily living activities across 10 different areas, including pain intensity, personal care, lifting, walking, sitting, standing, sleep, changes in pain, social life, and travel [13]. Scores range from a minimum of 0 to a maximum of 50. The questionnaire was

filled out in person prior to treatment and was administered via telephone one week post-treatment.

*Treatment Protocol*

Participants underwent a single session of OMT (Figure 1). Immediately after the treatment, the participants were asked to walk for 5 minutes and then orofacial pain, pressure pain threshold, TMJ ROM and SIJ mobility were assessed as a second evaluation. Functionality was assessed 1 week later as the third evaluation. The OMT treatment program included trigger point therapy, myofascial release, TMJ traction, joint mobilization with traction, muscle energy technique, mandibular fascia release, occipital release, and ligament therapy [14, 15].

*Statistical analysis*

G*Power V3.1.9.2 was used to calculate the sample size of the study. The effect size calculated based on the study of Fink et al. (Faber test pre-intervention=16.3±3.8, post-intervention=18.4±3.8) was determined as f=0.55 [5]. Accordingly, the minimum sample size to was reached with a power of 0.80 for α=0.05 type 1 error probability was calculated as 23 people.

IBM Statistical Package for Social Sciences 24 (SPSS, Chicago, USA) statistical program was used for data analysis. Continuous variables were given as mean ± standard deviation, and qualitative variables were given as numbers and percentages (%). It was determined that the data showed normal distribution with the Shapiro–Wilk test, and the relationship between the variables was evaluated with Pearson correlation analysis. Paired Samples test was used to compare the evaluation results obtained before and after treatment. Statistical significance was taken as $p < 0.05$ in all measurements.

*Ethical Approval*

This study was approved by the Ethics Committee of Marmara University, Faculty of Medicine Clinical Researches (Date: 2023-05-05, No: 09.2023.675).

## Results

Out of the 53 who volunteered to participate in the study, 29 did not meet the inclusion criteria (Figure 2). Twenty-one of the participants were women (87.5%). The median age was 34.8 years and the median BMI was 26.2 kg/m2. 41.7% of the participants had a history of trauma, 8.3% had a history of surgery, 45.8% had allergies, 79.2% had gastrointestinal diseases, 91.7% chewed unilaterally, 70% had missing teeth, 100% had parafunctional habit and 75% had bruxism (Table 1). Statistically significant improvement were observed in the Orofacial VAS scores, all mandibular joint ROM values, PPT in masseter, temporalis after treatment in all participants ($p = .000$). Also, statistically significant improvement were observed in the PPT in SIPS, Patrick's Faber test score, and ODI score after treatment in all participants ($p = .000$), (Table 2). Positive significant relationship were found between the PPT in masseter, temporalis, and SIPS (r: 0.408, 0.411; p: 0.48, 0.46).

## Discussion

The relationship between the craniomandibular system and the SIJ and the mechanisms connecting the two remain unclear. To the best of our knowledge, this study is the first clinical research investigating the effects of OMT applied to the TMJ not only on

**Table 1.** Sociodemographic and clinical data of the study participants

| Parameter | | X ± SD |
|---|---|---|
| Age (years) | | 34.8 ± 13.1 |
| Weight (kg) | | 70.3 ± 16.1 |
| BMI (kg/m²) | | 26.2 ± 5.5 |
| Height | | 1.63 ± 0.1 |
| **Parameter** | | **X ± SD** |
| Sex | Female | 21 (87.5%) |
| | Male | 3 (12.5%) |
| Education Level | Education level below high school | 13 (54.2%) |
| | High school and above education level | 11 (45.8%) |
| Trauma history | Yes | 10 (41.7%) |
| | No | 14 (58.3%) |
| Surgery history | Yes | 2 (8.3%) |
| | No | 22 (91.7%) |
| Allergy | Yes | 11 (45.8%) |
| | No | 13 (54.2%) |
| Gastrointestinal Diseases | Yes | 19 (79.2%) |
| | No | 5 (20.8%) |
| Unilateral chewing | Yes | 22 (91.7%) |
| | No | 2 (8.3%) |
| Bruxism | Yes | 18 (75%) |
| | No | 6 (25%) |
| Presence of missing teeth | Yes | 13 (54,2%) |
| | No | 2 (45,8%) |
| Parafunctional habit | Yes | 24 (100%) |
| | No | 0 (0%) |

X: Mean, SD: Standard Deviation, BMI: Body Mass Index.

**Table 2.** Pre and post treatment in Orofacial Visual Analogue Scale, all mandibular joint range of motion, pressure pain treshold in masseter, temporalis, and SIPS, Patrick's Faber test, and Oswestry Disability Index

| Parameter | X ± SD Median (Min-Max) | | P value |
|---|---|---|---|
| | Pre - treatment | Post - treatment | |
| Orofacial VAS | 7.7 ± 1.1 | 3.7 ± 1.6 | 0.000[a] |
| | 8 (6 - 10) | 4 (0 - 7) | |
| Depression ROM (cm) | 4.2 ± 0.4 | 4.7 ± 0.3 | 0.000[a] |
| | 4.2 (3.2 - 5.2) | 4.6 (3.9 – 5.6) | |
| Protrusion ROM (cm) | 0.4 ± 0.2 | 0.5 ± 0.2 | 0.000[a] |
| | 0.4 (0.1 - 0.8) | 0.5 (0.3 - 1) | |
| Right lateral deviation ROM (cm) | 0.7 ± 0.3 | 0.9 ± 0.2 | 0.000[a] |
| | 0.7 (0.1 – 1.2) | 1 (0.5 – 1.3) | |
| Left lateral deviation ROM (cm) | 0.8 ± 0.1 | 1 ± 0.1 | 0.000[a] |
| | 0.8 (0.5 – 1.1) | 1 (0.6 – 1.4) | |
| PPT in masseter | 4.5 ± 1.4 | 9.1 ± 3.2 | 0.000[a] |
| | 4.5 (2.3 – 7.5) | 8.5 (5 – 17.1) | |
| PPT in temporalis | 5.3 ± 2.2 | 9.6 ± 4 | 0.000[a] |
| | 4.9 (2.5 – 10.1) | 9.1 (4.5 – 17.9) | |
| PPT in SIPS | 5.5 ± 2.4 | 9 ± 2.7 | 0.000[a] |
| | 5.3 (1.1 – 11.4) | 8.1 (4.8 – 15) | |
| Patrick's Faber Test (cm) | 18.1 ± 0.8 | 15.3 ± 0.9 | 0.000[a] |
| | 17.8 (16.9 – 19.8) | 15 (13.8 – 17.3) | |
| ODI | 39.6 ± 7.3 | 29.2 ± 5.1 | 0,000[a] |
| | 41 (24 - 52) | 29 (18 – 40) | |

a: Paired Samples Test, X: Mean, SD: Standard Deviation, VAS: Visual Analogue Scale, ROM: Range of Motion, PPT: Pressure Pain Treshold, SIPS: Spina Iliaca Posterior Superior, ODI: Oswestry Disability Index, Bold emphasis indicates $p < 0.05$, P significance level.


**Figure 1.** Orofacial Manual Therapy

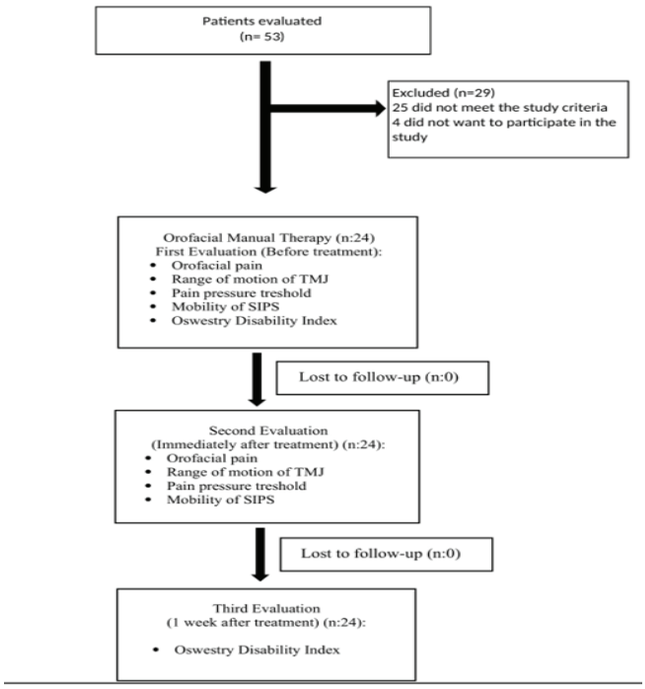


**Figure 2.** Flow Chart

TMD symptoms but also on SIJ symptoms.

After a single-session treatment, participants showed significant improvements in pain levels, pressure pain thresholds of the masseter and temporalis muscles, and all ranges of motion ROM of the TMJ. Furthermore, enhancements in orofacial pain, all TMJ ROM values, and the pressure pain thresholds of the masseter and temporalis—resulting from orofacial manual therapy—also contributed to better mobility and pressure pain thresholds of the SIPS, along with improved overall functionality.

Although the relationship between TMD and SJD is difficult to explain, a study conducted on healthy individuals [5] showed that hypomobility functional abnormalities of the SIE emerged after artificial occlusal intervention and suggested that there was a correlation between functional abnormalities of the TMJ and SIJ, which were thought to result from ventrodorsal muscle imbalances. In a study comparing the three-dimensional motion SIEs of patients with TMJ disorders and healthy individuals, it was found that especially joint disc disorders (the most common anterior disc displacement with reduction) may alter the kinematics of the sacroiliac joint [16]. This result indicates that there are statistically significant differences in SIJ kinematics between patients with TMD and healthy individuals. However, it remains unclear whether TMD is the cause or the consequence of these changes. In another study, the function of SIEs was evaluated using functional tests before and after stabilizing the abnormal position of the mandibular condyle in patients with TMD with the use of a temporary silicone occlusal splint [17]. Significant improvements in test results were observed following the stabilization of the mandibular condyle. Several case studies have also suggested a correlation between TMD and SIJD [6, 7]. Chinappi et al. observed that simultaneous chiropractic and orthodontic treatment in a patient presenting with SIJD complaints resulted in an improvement in SIJD symptoms and indicated a potential connection between these two areas [6]. In a study where neural therapy was applied to the TMJ, masseter muscle, and C4 level of a patient with both TMD and SIJD, a reduction in the patient's SIJD symptoms was observed [7]. In this study, improvements in SIJ hypomobility and pressure pain threshold were obtained after OMT was applied to patients with both TMD and SIJD. This results demonstrate a coexistence of these two dysfunctions. However, further research is needed to determine their causative relationships and outcomes.

In the study by Oliveira et al., the effects of occlusal splint and physiotherapy treatment on postural balance were investigated in patients with TMD using a stabilometric platform [18]. A statistically significant increase in antero-posterior velocity was observed in all patients, indicating that this result impacted postural balance. Chung et al., who examined changes in the gait of patients with lower extremity disorders using exercise equipment for TMJ, concluded that the pelvic center point swayed less during the one-legged stance test due to increased stability after treatment [19]. They also reported statistically significant differences in hip, knee, and ankle angles during walking, with these angles returning to the normal range. Tecco et al. found that TMJ disorders were associated with statistically significant changes in walking function based on gait analysis [20]. Although gait analysis was not used in this study, a questionnaire addressing daily life functions—such as walking, sitting, and carrying loads—was utilized. Significant improvements were noted in patients' daily life functionality following treatment. These results can reflect the relationship between TMD and SIJD and its impact on functionality.

Manual therapy approaches have an important role in TMJ function, ROM and pain [9, 21]. In this study, after the treatment of orofacial pain, pressure pain threshold in masseter, and temporalis muscles, and ROM values improved in participants. These results may occur due to pain modulation via activating low-threshold Aβ fibers pathway. This inhibits nociceptive

stimuli from Aδ and C supply fibers. MT can also elicit affective responses activating opioid, oxytocin, and dopaminergic pathways [22]. Due to these effects, several theories exist regarding how improvements in TMD achieved through OMT may impact the SIJ. The relationship between TMJ and SIJ is based on diaphragms, neural connections, and the presence of myofascial chains. The trigeminal nerve is significant due to its role in maintaining postural control, while fascia is of potential importance because it can transmit tension and, through its proprioceptive and nociceptive functions, contribute to referred pain and functional impairments in distant anatomical structures [9]. Additionally, there are five anatomical diaphragms in the body. These are: the diaphragm muscle, the pelvic floor, the floor of the mouth, the thoracic outlet, and the tentorium of the cerebellum. Previous work has shown the connections between all these diaphragms, with links to fascial and neurological continuity (23). The function of these diaphragms is to regulate and respond to any changes in intra-abdominal pressure. For instance, if the main inspiratory muscle descends during inhalation, there will be a corresponding lowering of the pelvic floor. With all these connections, symptoms may also manifest in areas far from the source of the problem [8]. The sacroiliac joint is a gliding joint formed by the iliac and sacral bones, reinforced by the interosseous sacroiliac ligaments, the anterior sacroiliac ligaments, and the dorsal sacroiliac ligaments. The range of motion at the sacroiliac joint is minimal. Therefore, any disorder of this joint and its connections with the structures mentioned above leads to dysfunction [24].

Our study has several limitations. It should be recognized that we assessed immediate effects of OMT on orofacial pain, pressure pain threshold, TMJ range of motion, hipomobility in SIJ, and functionality. Immediate changes occurred after OMT treatment provides impetus for future research in this area. Future studies should investigate the long-term effects of this intervention using larger sample sizes in randomized controlled designs. Another limitation is that we cannot rule out the placebo effect due to the absence of a control group. The wide age range of the participants and the lack of a comparison between genders are additional limitations. Future studies should include participants within a specific age range and investigate the effects of gender.

In summary, comprehensive evaluation of patients diagnosed with TMD and considering the patient and their body as a whole is important in the treatment of TMD. Since the body is interconnected kinematically, specific regions shown to have intimate, yet distal, involvement such as the TMJ and pelvis, warrant close clinical attention. With a specific group of patients evaluation and treatment of the TMJ may be essential for a successful clinical outcome in treatment of the sacroiliac joint. Conversely with a subset of some patients, evaluation and treatment of the sacroiliac joint may be essential for a successful clinical outcome in treatment of the stomatognathic dysfunction.

### *Conclusion*

Therefore, when faced with a patient with TMD symptoms, it would be reasonable to question SIJD complaints and include an examination of the TMJ followed by investigations of these anatomical areas where it is deemed appropriate. As the symptoms of TMJ improved, the pressure pain threshold and the mobility of the SIJ also improved.

### *Clinical Implication*

- One session of orofacial manual therapy can improve symptoms of temporomandibular disorder (TMD).
- As pressure pain threshold (PPT) values in the temporomandibular joint (TMJ) improved, PPT values in the sacroiliac posterior superior (SIPS) also improved.
- In patients admitted to the hospital with sacroiliac joint dysfunction (SIJD), it is recommended to evaluate the temporomandibular joint (TMJ) to achieve more effective treatment results.

***Scientific Responsibility Statement***

*The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.*

***Animal and Human Rights Statement***

*All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.*

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***Conflict of Interest***

*The authors declare that there is no conflict of interest.*

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